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ECONOMIC ANALYSIS OF ALTERNATE INTERSTATE HIGHWAY ROUTINGS BETWEEN FORSYTH AND MILES CITY

FOREWORD

This analysis has been prepared for the purpose of comparing the relative merits of two proposed routings of the Interstate System highway between Forsyth and Miles City. In determining the route which would be most favorable, consideration is granted to two sets of economic factors which have a bearing on route selection. The first set of factors includes such capital investment items as right-of-way, engineering, structures and roadway construction costs, and also the cost of maintenance. The second set of factors includes the highway-user costs as measured in direct vehicular operating costs and related overhead and time element costs.

Both sets of factors have a definite bearing on the selection of the most favorable route, and they must be considered in combination in order to arrive at a composite conclusion. As an illustration, it might be possible to select a route which would have a relatively low construction cost, but such a route might be located considerable distance from population centers or other traffic generators, with the result that the usage of the highway would be limited and the cost of traveling between termini would be increased substantially. Conversely, a location, which was selected on traffic considerations only, might traverse well developed and costly land or terrain which would be excessively expensive from a construction standpoint.

In the final answer, the most favorable route would be the one that would have the lowest overall cost when all factors are taken into consideration.

DESCRIPTION OF ROUTES

After inspecting aerial photographs, maps and other material and making detailed field investigations, the Interstate Division selected two routes between Forsyth and Miles City as being the most appropriate locations on each side of the Yellowstone River. These routes will be defined as the North Route and the South Route in relation to their geographic position. The locations are shown on the attached map.

Both routes occupy a common line eastward through Forsyth to a point of interchange just east of the limits of that city. The North Route crosses the Yellowstone River in that vicinity, extends in an easterly direction along the north side of that river and re-crosses the river in the area to the west of Miles City. It then extends to a point of common terminus with the South Route west of Miles City. The population of Forsyth is 1,906 and that of Miles City is 9,243.

The South Route follows a line in close proximity to the present highway between the points of common terminus. Moderate deviations from the present line are made at several points in order to avoid developed areas or to improve the line and grade of the present highway.

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The following is a more detailed description of the routes and the service which each provides:

NORTH ROUTE. After leaving the common terminus east of Forsyth, this route crosses the Northern Pacific Railway tracks and the Yellowstone River with a combination structure. It then extends northerly through an irrigated area and across the Chicago, Milwaukee, St. Paul and Pacific Railroad tracks to a point on the county road on the north side of the river. It is then located in an easterly direction along the north edge of the area which is irrigated by the Cartersville Canal. The location in this vicinity has been chosen in order to avoid most of the irrigated land and also to minimize the problems of access control.

In the vicinity of Thurlow, irrigated land and access control become a minor problem, and the route then follows along or in close proximity to the present county road. The C. M. S. P. & P. R. R. tracks are crossed again in the vicinity of Paragon, and the route then recrosses the Yellowstone River to the point of common terminus about 5 miles west of Miles City.

The land is almost level throughout the entire length of this route. Aggregate material appears to be quite scarce except towards the ends of the route where gravel benches are located. Excavation should be simple, but it may be necessary to haul much of the fill material.

This route serves a well developed and established irrigated farming area on the north side of the Yellowstone River. As is customary with irrigated areas, the dwellings are closely spaced and there is considerable generation of traffic. The area is served at present by FAS Route 446, but improvement of the existing road has been deferred until such time as a decision has been reached concerning the location of the Interstate highway.

A count reveals that there are about 80 dwellings and 3 other establishments within a corridor bounded by the river on the south and a line about 2 miles north of the proposed Interstate highway. Assuming 3.2 persons per dwelling, this route would provide direct service to about 265 persons.

Traffic from intersecting roads amounts to about 35 vehicles per day, excluding the connection to the community of Rosebud.

The length of the route is 41.5 miles.

SOUTH ROUTE. The proposed location of this route would follow the general line of the present highway on the south side of the Yellowstone River. At several points, the proposed line will deviate from the present highway in order to improve the alignment and grade or to reduce the rise and fall.

Most of the land traversed by the route consists of dry-farming or grazing land, with an insignificant amount of irrigated land. The terrain is varied, consisting of river plain, benchland and some hilly country. The route crosses several drainage courses, some of which are of substantial width. The rise and fall on the present highway between Forsyth and Miles City amounts to about 4,000 feet, of which about 575 feet is overall rise and fall between the high point and the low points at the termini. Much of the intermediate rise and fall can be eliminated under present standards of highway construction.

There will be some heavy grading along this route. Aggregate material appears to be plentiful and fairly well distributed.

About 34 dwellings and 7 other establishments are located in a corridor bounded on the north by the river and on the south by a line about two miles south of the present highway. In addition, this route serves the communities of Hathaway, (population 27) and Rosebud, (population 250). Rosebud is a local center of interest and has 2 churches, 2 schools, bar, post office, general store, railroad facilities and 2 service stations.

Another consideration of primary importance in the location of the highway is the service which this route provides to a radar installation which is located about 10 miles southwest of Miles City. This facility is in operational status, but there is additional construction to complete before it will attain full status. It is estimated that construction will be completed in about 17 months. This is a central installation with satellite stations near Glendive and Brockway.

In addition to its importance in connection with the defense aspects of the Interstate highway system, this base will generate a substantial volume of traffic. It is reported that housing on the base will be provided for 27 families and 100 single persons. In addition, about 50 families may be expected to live in Miles City. The normal complement at the base will consist of 250 persons, with an additional 50 persons of itinerant status.

The recreational and service facilities at the base are limited, and as a result, most of the personnel spend their off-duty time in Miles City. Also, the base supplies are hauled from Miles City. These practices create a substantial volume of traffic between the two points.

Traffic from roads which intersect the South Route amounts to 242 vehicles per day, excluding the Rosebud connections. Traffic counts show that the west Rosebud connection carries 277 vehicles per day. Counts are not available on the east Rosebud connection, but it is estimated that 100 vehicles per day use this connection.

The length of the route is 39.5 miles.

CONSTRUCTION AND MAINTENANCE COSTS

The estimated construction costs and the construction length, as reported by the Interstate Division, are shown in the table which follows. It may be noted from this table that the costs of all items are greater on the South Route, with the exception of Surfacing, Railroad Crossings, and River Bridges. The extra cost of the other items is the result of the heavier grading on this line, the crossing of numerous drainage courses, and the higher right-of-way costs.

The surfacing costs on the North Route are greater because of the additional length of this route. This line also involves two railroad crossings and two river bridges at an estimated total cost of $2,244,000. The extra cost of these structures makes the total cost on the North Route exceed that of the South Route by $757,120.00.

When reduced to an annual cost basis, including maintenance, the North Route would have an annual cost of $294,138 as compared with $277,058 for the South Route, or a difference of $17,080 in favor of the South Route.

TABLE NO. 1

CONSTRUCTION AND MAINTENANCE COSTS

ITEM	ESTIMATED SERVICE LIFE	NORTH ROUTE - 41.5 MILES			SOUTH ROUTE - 39.5 MILES		
			COST			COST	
		QUANTITY	TOTAL	ANNUAL	QUANTITY	TOTAL	ANNUAL
Earthwork	40 years	3,154,000 cu. yds. @ 20¢	$ 630,800	$ 15,770	4,062,700 cu. yds. @ 20¢	$ 812,540	$ 20,314
Drainage Structures	40 years		828,000	20,700		1,430,200	35,755
Stock & Machinery Passes	40 years	17	249,520	6,238	22	329,500	8,238
Surfacing	20 years		2,415,300	120,765		2,298,900	114,945
Drainage	40 years	Light to Moderate	174,720	4,368	Light to Heavy	177,020	4,426
Right-of-Way (Land Only)	50 years		122,280	2,446		152,960	3,059
Homes & Businesses	50 years		24,000	480		213,000	4,260
Frontage Road	40 years	1.75 miles	19,250	481	5.80 miles	63,800	1,595
Railroad Crossings	50 years	920 lin. ft. @ $700/ft.	644,000	12,880		- - -	- - -
River Bridges	50 years	2,000 lin. ft. @ $800/ft.	1,600,000	32,000		- - -	- - -
Interchanges	50 years	5	788,000	15,760	8	1,260,800	25,216
TOTALS			$7,495,870	$ 231,888		$ 6,738,720	$ 217,808
COST PER MILE			$ 180,623			$ 170,600	
ANNUAL MAINTENANCE COST AT $1,500 PER MILE				62,250			59,250
TOTAL ANNUAL COST				$ 294,138			$ 277,058

SAVINGS IN FAVOR OF SOUTH ROUTE $ 17,080

In comparing the relative importance of the Interstate routes, it is also necessary to consider the effect that each route would have on the overall transportation situation in this area.

If the Interstate highway were to be built on the north side of the river, there would be a significant adjustment in the traffic pattern and usage of the Rosebud-Cartersville-Thurlow road. It would be safe to assume that practically all of the travel from the north side of the river to Forsyth and Miles City would be by way of the Interstate highway. There remains, however, a substantial volume of traffic of local origin and circulation that would continue to use the local roads. A large part of this traffic would continue to travel to Rosebud because of the facilities in this community such as the schools, churches, post office, store, and the railroad shipping facilities. Under these conditions, it appears that the Rosebud-Cartersville-Thurlow road should be built to Secondary System standards even if the Interstate highway were to be built on the north side of the river. There is no question that it should be improved to Secondary System standards if the Interstate highway is built on the south side of the river.

If the North Route were to be constructed, it would be necessary to retain present U. S. No. 10 on the south side of the river to serve the substantial amount of traffic on this side of the river which would not be able to use a northside Interstate highway. This interior traffic comes from the local dwellings, numerous intersecting roads, the communities of Rosebud and Hathaway, and the radar installation.

The present highway on the south side was built during the period of 1928 to 1930. With a high proportion of the traffic, including the heavier vehicles, transferring to the northside Interstate highway, it would continue to provide tolerable service to the remaining vehicles for a few years. The point will be reached, however, where it will be necessary to reconstruct the present highway, and the cost of maintaining and reconstructing the highway must be taken into consideration in analyzing the overall transportation situation.

The following table shows the estimated cost of this companion construction:

CONSTRUCTION OF FAS ROUTE 446 - ROSEBUD-CARTERSVILLE-THURLOW

Roadway - 11.6 miles @ $50,000 per mile =	$ 580,000	÷ 30 years =	$19,333
Yellowstone River Bridge	600,000	÷ 50 years =	12,000
	$1,180,000		$31,333
Maintenance - 11.6 miles @ $500 per mile			5,800
TOTAL ANNUAL COST			$37,133

RECONSTRUCTION OF PRESENT U.S. NO. 10

Rebuild 39.5 miles @ $70,000 per mile = $2,765,000 ÷ 30 years	$ 92,167
Maintenance - 39.5 miles @ $1,000 per mile	39,500
TOTAL ANNUAL COST	$131,667

The following results are obtained when the Interstate Construction and maintenance costs are combined with similar costs for the required companion construction:

	ANNUAL AMORTIZED COSTS	
	NORTH ROUTE	SOUTH ROUTE
Interstate highway	$ 294,138	$ 277,058
FAS 446 - Rosebud-Cartersville-Thurlow	37,133	37,133
Reconstruct present U.S. No. 10	131,667	- - -
TOTAL	$ 462,938	$ 314,191
ANNUAL SAVINGS IN FAVOR OF SOUTH ROUTE		$ 148,747

These estimates show that the annual cost of constructing and maintaining the Interstate highway by itself would be $17,080 lower on the South Route. When the Interstate highway costs are considered in conjunction with the costs for companion construction, there would be a differential of $148,747 per year in favor of the South Route.

TRAFFIC

Traffic counts of present U. S. No. 10 show that there is an average of 1,350 vehicles per day traveling the section of highway between Forsyth and Miles City. Traffic distribution is as follows:

Location	Vehicles Per Day
East of Forsyth	1,780
Near Rosebud	1,400
Near county line	1,130
Near Miles City	1,500
Average	1,350

Of the 1,350 total, it is estimated that 1,078 vehicles per day consist of through travel between termini and the remaining 272 vehicles have interior origins, destinations, or both.

The traffic on FAS Route 446 amounts to 230 vehicles per day from Rosebud to Cartersville and 115 vehicles per day from Cartersville to Thurlow. The present county road on the north side of the river carries an average of 60 vehicles per day from Cartersville west to Montana No. 6 and an average of 50 vehicles per day from Thurlow east to Montana No. 22.

It is generally accepted that improved highway facilities will encourage increased travel, but for the purpose of this analysis, it appears that the amount of increase would be proportionate for either Interstate highway routing regardless of the distribution between induced, generated or diverted traffic. For that reason, traffic assignment has been made on the basis of present traffic volumes.

If the Interstate highway were to be built on the south side of the river, there will be very little modification of present travel patterns. As described in the portion pertaining to construction and maintenance costs, it is expected that FAS Route 446 would be constructed to Secondary System standards, so it may be assumed that traffic from the north side of the river would follow the present practice of traveling to the south side of the river and using the southside highway for travel to Forsyth and Miles City. Also, the present traffic on U. S. No. 10 would continue to use this location as an Interstate highway. It is doubtful that traffic on the eastern or western ends of the present county road north of the river would reverse the normal movement in order to get on the Interstate highway south of the river. Traffic assignment for the South Route has therefore been made on the basis of present movements.

The situation would differ considerably if the Interstate highway were to be built on the north side of the river. It is assumed that the 1,078 vehicles per day of through traffic, now using the southside highway, would divert to the northside Interstate highway. Also, the traffic originating in the developed area on the north side of the river could be expected to use the northside Interstate highway for all trips to Forsyth and Miles City. A portion of the present travel on the north side of the river consists of trips of local circulation or trips into Rosebud. It is assumed that these trips would continue to follow the present pattern.

Assignment of traffic on the basis of these considerations, produces the following results:

NORTHSIDE INTERSTATE HIGHWAY WITH FAS 446 FROM ROSEBUD TO THURLOW AND RECONSTRUCTED SOUTHSIDE HIGHWAY

TYPE OF TRAFFIC	AVERAGE DAILY TRAFFIC
Through traffic from Forsyth to Miles City	1,078
Local traffic of northside origin	200
TOTAL INTERSTATE TRAFFIC	1,278
From U. S. No. 10 to Rosebud vicinity	152
Rosebud to Cartersville	120
Cartersville to Thurlow	55
AVERAGE SECONDARY SYSTEM	75
On local roads not using Interstate or Secondary routes	25
On reconstructed southside highway	272

SOUTHSIDE INTERSTATE HIGHWAY WITH FAS FROM ROSEBUD TO THURLOW

TYPE OF TRAFFIC	AVERAGE DAILY TRAFFIC
Through traffic from Forsyth to Miles City	1,078
Local traffic or interior origin or destination	272
TOTAL INTERSTATE TRAFFIC	1,350
From U. S. No. 10 to Rosebud	270
Rosebud to Cartersville	230
Cartersville to Thurlow	115
AVERAGE SECONDARY SYSTEM	148
On local roads west of Cartersville	60
On local roads east of Thurlow	50

In conjunction with the assignment of traffic, trip lengths were measured via the various routings and types of roads in order to arrive at an estimate of the number of vehicle-miles of travel involved under the two Interstate routings and companion routings. The vehicle-miles of travel on each road type were then multiplied by unit cost factors for each type of road to determine the total cost to the highway user under each proposal. The cost factors vary according to type of surface, curvature, rise and fall and other features which affect vehicular operating costs. The following shows the extremes of costs arranged by vehicle groupings:

TYPE OF VEHICLE	RANGE OF COSTS PER VEHICLE-MILE OF TRAVEL LOWEST UNIT COST	HIGHEST UNIT COST
Passenger Cars	$.0919 on level Interstate	$.1383 on poor gravel
Single-Unit Trucks	$.1925 on level Interstate	$.2896 on poor gravel
Combination Trucks	$.4269 on level Interstate	$.5085 on hilly Primary *

* The amount of travel of combinations on other than oiled roads would be negligible.

The foregoing costs include the direct operating costs, value of driver's time, and other overhead costs such as depreciation, insurance, and related items.

TRAVEL AND COST DATA

The following table presents the results of the assignment of traffic, the computation of vehicle-miles of travel, and the application of the unit costs to the amount of travel via the different routings and road types:

	NORTH ROUTE COMBINATION			SOUTH ROUTE COMBINATION		
TYPE OF FACILITY	DAILY VM OF TRAVEL	COST PER VM	DAILY COST	DAILY VM OF TRAVEL	COST PER VM	DAILY COST
Interstate System	59,379	$.1399	$8,307.12	55,825	$.1403	$7,832.25
Primary System	7,038	.1627	1,145.08	4,250	.1556	661.30
Secondary System	695	.1200	83.40	1,414	.1200	169.68
Local Roads	200	.1448	28.96	2,323	.1512	351.24
TOTAL	67,312	$.1421	$9,564.56	63,812	$.1413	$9,014.47

Conversion of these daily totals to annual totals results in the following:

	ANNUAL VM OF TRAVEL	ANNUAL COST OF TRAVEL
NORTH ROUTE COMBINATION	24,568,880	$3,491,064
SOUTH ROUTE COMBINATION	23,291,380	$3,290,281
SAVINGS IN FAVOR OF SOUTH ROUTE	1,277,500	$ 200,783

COMBINED COST DATA

The following table presents a comparison of annual construction and maintenance costs and highway-user costs classified by highway system and also grouped as a combination with the North Interstate Route and the South Interstate Route.

HIGHWAY SYSTEM & TYPE OF COST	NORTH ROUTE COMBINATION	SOUTH ROUTE COMBINATION	SAVINGS IN FAVOR OF -	
			NORTH COMB.	SOUTH COMB.
INTERSTATE				
Construction & Mtce. Costs	$ 294,138	$ 277,058	$	$ 17,080
Highway-User Costs	3,032,099	2,858,771		173,328
	3,326,237	3,135,829		190,408
PRIMARY				
Reconstruction & Mtce. Costs	131,667	- - -		131,667
Highway-User Costs	417,954	241,374		176,580
	549,621	241,374		308,247
SECONDARY				
Construction & Mtce. Costs	37,133	37,133	-0-	-0-
Highway-User Costs	30,441	61,933	31,492	
	67,574	99,066	31,492	
LOCAL ROADS				
Highway-User Costs	10,570	128,203	117,633	
ALL SYSTEMS				
Construction & Mtce. Costs	462,938	314,191		148,747
Highway-User Costs	3,491,064	3,290,281	149,125	349,908
	$ 3,954,002	$ 3,604,472	$ 149,125	$ 498,655
ANNUAL NET SAVINGS IN FAVOR OF SOUTH ROUTE				$ 349,530

SUMMARY

This analysis shows that the most favorable location for the Interstate System highway would be on the south side of the Yellowstone River. This route would be 2 miles shorter than a northside location. It would serve 1,350 vehicles per day as compared with 1,278 for the northside route. It would cost $17,080 per year less to construct and maintain the South Route. This differential in cost is due mostly to the fact that two river bridges and two railroad crossings would be required on the North Route, whereas these structures could be avoided by remaining on the south side of the Yellowstone River. It would also save the highway-user $173,328 per year, principally because of the shorter travel distance of two miles.

When considered in the light of other needed highway improvements in this vicinity, the most economical solution would be to construct the Interstate highway on the south side of the river and to construct a secondary road from the Interstate highway northward to Cartersville and eastward to Thurlow. This road is presently included in the Federal-aid Secondary System and is designated as FAS Route 446. Such FAS construction would provide an oiled road to serve the more highly developed portion of the area north of the Yellowstone River. It would leave only a few dwellings north of the river which would not be served by an oiled highway.

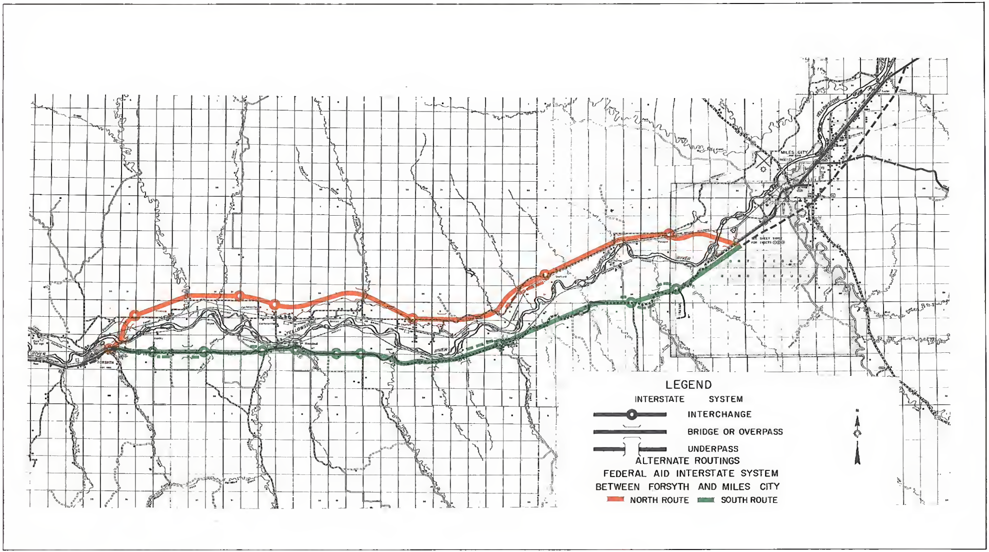
If the Interstate highway were to be constructed on the north side of the Yellowstone River, it would still be necessary to construct the Secondary highway to serve the traffic of local circulation. In addition, it would be necessary to retain the present highway on the south side of the river to serve the traffic from adjacent dwellings, intersecting roads and the communities of Rosebud and Hathaway. It is also important that highway service be maintained for the radar installation and the Forsyth airport, both of which are located along the present southside highway.

Although the condition of the present southside highway is such that it could continue to serve traffic for some years, it can be expected that excessive maintenance costs would soon require reconstruction of this highway. This reconstruction cost, as well as dual maintenance costs, could be avoided if the Interstate highway were to be built on the south side of the river to replace the present highway.

When the situation is analyzed from the standpoint of the Interstate System alone, the South Route would save $17,080 per year in construction and maintenance costs, and in addition, it would save the highway-user $173,328 per year in travel costs. This would make a total savings of $190,408 per year in favor of the South Route.

When the Interstate highway location is considered in conjunction with the general highway transportation situation in this region, the combination of a South Interstate highway and an oiled Secondary route from Rosebud to Thurlow would provide the most economical highway service. This combination would save $349,530 per year over the alternate proposal of a North Interstate highway, an oiled Secondary route from Rosebud to Thurlow, and retention of present U. S. No. 10 on the south side of the river.

THE RESULTS OF THIS ANALYSIS SUPPORT THE LOCATION OF THE INTERSTATE SYSTEM HIGHWAY ON THE SOUTH SIDE OF THE YELLOWSTONE RIVER AND THE CONSTRUCTION OF AN OILED SECONDARY HIGHWAY TO SERVE THE ROSEBUD-CARTERSVILLE-THURLOW TRAFFIC.



ALTERNATE ROUTINGS
FEDERAL AID INTERSTATE SYSTEM
BETWEEN FORSYTH AND MILES CITY

🟥 NORTH ROUTE 🟩 SOUTH ROUTE